Facial recognition technology for next-generation fish-count surveys

This article is contributed by ADL

In the latest generation of the CAM-Trawl system developed by the Fish Management Acquisition (FMA) program, ADL worked with NMFS Alaska Fisheries Science Center making key improvements to the computer portion of the CAM-Trawl system, including higher compute performance, standards-based vision software, more rugged enclosure and user-friendly LED indicators.

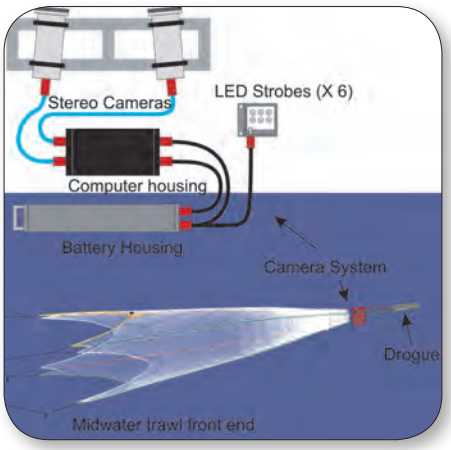

Figure 1. First generation CAM Trawl Picture

The conservation and management of fish stocks relies heavily on fish-count surveys. In an effort to improve the shortcomings of these surveys, NOAA (National Oceanic and Atmospheric Administration) and its National Marine Fisheries Service (NMFS) developed a camera-based trawl (CAM-Trawl) to bring the power of image capture and facial recognition technology to best address this problem. The Alaska Fisheries Science Center is the research branch of the National Oceanic and Atmospheric Administration National Marine Fisheries Service responsible for research on living marine resources in the coastal oceans off Alaska and parts of the West Coast of the United States. This region of nearly 3 million square miles includes the North Pacific Ocean and the East Bering Sea which support some of the most important commercial fisheries in the world. These waters are also home to the largest marine mammal populations in the nation.

The conservation and management of fish stocks relies heavily on fish-count surveys. Traditionally, this has been done through the use of fishing trawlers set up to do acoustic or bottom trawling which cast enormous nets into the sea to capture as many fish as possible over a specified area. These fish are then brought on-board and manually counted to develop the trawl survey. This methodology suffers from a number of shortcomings: errors associated with extrapolating from a small area survey to large area estimates, errors associated with extrapolating from the relatively long period of time necessary to gather and count fish over a region to real-time characteristics of the fish population, the relatively high cost of time and equipment for manual trawl surveys, the fact that some small fish species of interest are too small to be caught by the net mesh, and lastly, the fact that killing fish in the course of a trawl survey affects local fish populations which can sometimes be dangerously low.

As a result, NOAA (National Oceanic and Atmospheric Administration) and its National Marine Fisheries Service (NMFS) have been working for a number of years on a camera-based trawl (CAM-Trawl) technology to bring the power of image capture and facial recognition (loosely termed, Fishal Recognition) technology to best address the problem. Early generations of this CAM-Trawl system used the lengthy process of image capturing, storing images, and then removing the storage media for image analysis at some later time back at the lab.

In the latest generation of the CAM-Trawl system developed by the Fish Management Acquisition (FMA) Program, ADL Embedded Solutions worked closely with the NFMS Alaska Fisheries Science Center to make key improvements to the computer portion of the FMA CAM-Trawl system. These include the following. Upgrading to GeniCam-compliant vision platform to take advantage of the latest camera technology and image recognition algorithms. Upgrading to marine quality system enclosure with IP-67 rated ingress protection. Upgrading to a quad-core Intel Core i7 processor to enable real-time processing of image data. Design and building of a rugged small form factor system for mounting flexibility and ease of storage and transportation. The resulting FMA computer solution from ADL has helped achieve all the stated goals for this project. Namely, real-time fish-count data analysis capability for NOAA marine researchers to aid in their fish conservation efforts is now a reality.

The new system includes an ADL main control computer shown at left and an ADL image acquisition computer on the right in figure 2. System features include: stainless steel, water-proof (IP67) enclosures, Intel Core i7 processors, IP67-rated water-proof circular connectors with protective caps, LED activity lights for various functions, removable drive assemblies, and Topside Handrail Mounting Adapter. The ADL image acquisition computer (Vision Box) is responsible for: camera interface using up to 6x GigE ports, image capture,

Figure 2. The housed ADL system

real-time image recognition using processing algorithms on the Intel Quad Core i7 processor, and image storage including metadata for data/time, fish identity, etc.

The ADL control computer typically resides in the wheelhouse. It will steadily monitor a number of external sensors including geo data, time, pressure sensors, RFID tag readings and will orchestrate one or more Vision Boxes based on sensor input. Remote power on/off, clock syncing, start/stop image acquisition, etc is all dictated by the ADL control computer in a one-to-many relationship.

The results for the new FMA system have been very positive after experimental trawl surveys in 2016. Work is now underway to standardize the key components of the new system as a means of promoting the adoption of this real-time Fishal Recognition FMA system on many more surveys in the near future. ■